WHAT IS AN INSECT?

by

LORAIN FARMER
Raymond Foundation

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What Is an Insect?

The next time you have a few minutes to spare, sit down and make a list of all the different insects that you can name. If you can write more than twenty-five names on your list, you will probably be doing better than the average person. But suppose you knew the name of every kind of insect in the world. If you were to write all these names, it would take you over a month, without stopping to sleep or eat, to complete your list because there are more kinds of insects than all the kinds of other animals and plants put together.

When you have made your list, look it over carefully, for you may have included some animals that are not insects at all. Sometimes spiders and ticks are mistaken for insects, but they belong to another group of animals. If you know what to look for, it is not difficult to tell whether or not an animal is an insect.

A cecropia moth, a honeybee, and a mosquito do not look very much alike. Yet each is an insect and, if you examine them, you will find certain things about them

Insects are found almost everywhere—from steaming jungles to polar regions. They are in the soil, in the air, and in the water.

that are similar. Each one of these animals has six legs, as all insects have, and the body of each is divided into three parts: a head, a center part, and an abdomen. If you remember these two characteristics, you will be able to recognize an insect. The next time you look at a spider, you will see that it has not six but eight legs and its body only two parts instead of three. Therefore it is not an insect.

Insects are found almost everywhere—from steaming jungles to polar regions, in the soil, in the air, and in the water. They seem to be able to live and thrive under almost any conditions.

Anyone who has ever slapped at a mosquito, stepped on an invading cockroach, or tried to cover a dog with flea powder will tell you that some insects are a nuisance. They not only interfere at times with our activities, but they also do damage to the extent of about a billion dollars each year in our country alone. Most of the damage is done by insects that feed on plants that we use, insects like the cotton-destroying boll weevil and the potato beetle and the tobacco hornworm. Also, some kinds of insects carry disease, and we try to control them on this account.

If, however, all the insects were suddenly to disappear from the earth, it would not be long until many other living things would vanish also, possibly even man himself. Apples, lemons, oranges, cherries, peaches, and many other kinds of fruit would be gone from our menus. Many vegetables and flowering plants would die also, for these plants cannot bear fruit or seeds unless an insect transfers their pollen. The fishes and birds that depend on insects for food would vanish, and many of the animals that depend, in turn, on these fishes and birds for food would soon starve. Once a link in nature's chain of life has been broken or removed, the entire chain is greatly weakened.

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THE HONEYBEE

by

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The Honeybee

Nearly all people, from the ancient Egyptians to present-day philosophers and engineers, have been impressed by the activities of the honeybee. The complex organization of the hive and the never-ceasing energy of the bees themselves have been a source of wonder and amazement to man for hundreds of years.

The dark interior of a beehive is the center of many different activities. Although one hive contains thousands of insects, there is no confusion. Each bee performs tasks that are necessary for the survival of the whole colony. Most of the honeybees in a hive are worker bees. As their name suggests, these bees gather the nectar and pollen, make the wax honeycombs, and care for the young bees. Although the worker bees are constantly busy at these many tasks, they alone could not keep the colony going for very long because they cannot lay eggs that will hatch into more workers. In every productive hive there is one bee, called the queen, that does nothing but lay eggs. She may lay as many as two thousand eggs in one day. The members of the third group in a bee colony are the drones or male bees.

For many years men have provided artificial homes for honeybees and in return have taken honey and bees-

wax. Beeswax is used in many articles, from phonograph records to candles. The sticky, golden liquid known as honey was probably the first sugar used by man. When you buy a pound of honey at the store, it is hard to realize all of the effort that goes into its production, but if you could watch one of the worker bees for several hours, you might discover some of the many interesting facts about honey-making.

When one of the worker bees leaves the hive to search for the nectar from which honey is made, it will probably cover several miles before it returns. Upon finding a flower from which nectar can be obtained, the worker hovers for a second and then drops, alights, and moves across the petal of the flower until it finds the source of the sweet nectar. Using its tongue, which acts as a sucking tube, the bee draws the nectar into its honey-bag or crop. When it has exhausted the nectar supply of one flower, it flies on to another until its crop is full.

On the flight back to the hive, many different substances in the bee's body are already at work changing the nectar into honey. If you were to go out in the country and gather nectar from the very same flowers that the bee visits, it would not be possible for you to make honey from it. Honey can be made only in the body of the honeybee.

Upon its return to the hive, the worker bee is met by several young workers, and the nectar, which now resembles very watery honey, is transferred to them. These bees then seem to mix the honey by forcing it in and out of their bodies several times. After this, the honey is ready to be stored in a wax cell and left until the excess water has evaporated. When the honey is thick and golden, as it is when we buy it, the bees place a cap of wax over the cell, sealing it until the honey is to be used for food during the winter.

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THE ANT LION

by

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The Ant Lion

One warm summer day a small ant hurricd along over the yellow sands of the Lakc Michigan dunes. Climbing over a smooth piece of driftwood and dodging around a bleached snail shell, it was at last nearing its destination, and it dashed quickly undcr an overhanging stone. Suddenly it found itself slipping down a steep bank of sand. It tried to brace its small legs and scramble back up, but the loosc grains of sand slipped from under it. Struggling and twisting, the ant catapultcd to the bottom of the pit, where a strong pair of jaws closed upon its body.

Many small insccts have met their death by falling into these cleverly built traps made by thc ant lion. This dragon of the dunes is only about half an inch long. Its short, squat body is a dirty gray color that makes it nearly invisible among the sand grains where it lives. Almost the instant that it hatches from the egg, the ant lion starts searching for a placc to build its trap. Watching it move is something like watching a movie run in reverse, for this strange insect always walks backward, never forward.

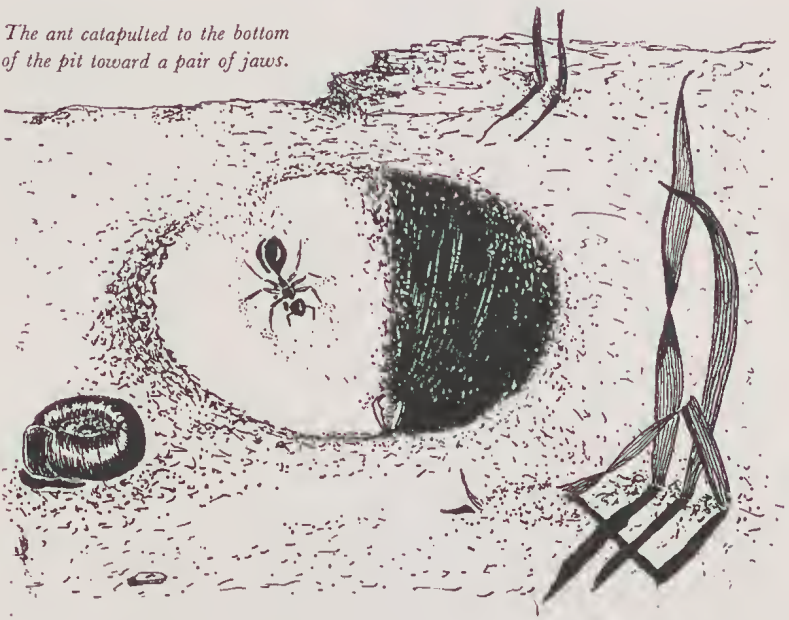
The ideal spot for the trap is sheltered, so that the sand will not be dampencd by rain or blown by the wind. When the ant lion has selected a location, it begins to scoop out a small circular trough in the sand. It uses the end of its body likc a miniature plough. When it has completed a circle, about two inches across, it starts ploughing a second, smaller circle inside the first circle.

As the sand is turned up, the ant lion tosses it outside with a quick jerk of its tiny, flat head. In this way, the insect continues until it has dug a pit shaped like a funnel. As soon as this pit is completed, the ant lion buries itself in the sand at thc bottom and lies in wait for some unwary insect. It will wait quietly for hours or even for days. Unless one looks very closely, the ant

lion eannot be seen in its trap. Only upon close inspection ean one see two hollow, eurved jaws stieking up out of the sand.

Onee a small inseet is eaught by these powerful jaws, there is little hope of eseape, for the ant lion quickly drains away the fluids of the insect and throws the empty skeleton out of the pit. Then it retreats into the sand to wait for its next vietim. If an inseet that has stepped over the edge of the trap gets a foothold and starts climbing out again, the ant lion showers it with grains of sand. Soon it is eaught in a landslide and brought within reaeh of the waiting jaws.

Like the ugly frog that ehanged into a handsome prinee in the fairy story, so the plain, squat little ant lion ehanges into a graceful winged adult that somewhat resembles a damselfly. This change takes plaee in a small ball of silk that the ant lion makes. Sinee the silk is stieky at first, grains of sand adhere to the outside of the eoeoon and serve to camouflage it.



The ant catapulted to the bottom of the pit toward a pair of jaws.

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THE MOSQUITO

by

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The Mosquito

The quavering wail of the sereech owl, the croaking chorus of the frogs, and the chirp of the crickets are all sounds of a summer night. These and many other night noises are pleasant to our ears. They remind us that, although the city streets are empty and quiet, the small trails and paths in the woodlands are alive with animal life. But there is one night sound that is a destroyer of peace and quiet. Although it is not loud, the steady, high-pitched whine of the mosquito is easily remembered by everyone who has ever heard it.

It is the female of our most common species of mosquito that is responsible for our discomfort. The males live a harmless life, feeding only on nectar or the juice of over-ripe fruit. In fact, we are seldom aware of them because they do not have mouthparts capable of piercing the skin of an animal. Female mosquitoes, however, seem to be very much attracted to warm-blooded animals. It is interesting to watch a female mosquito take a meal. She is well furnished with the necessary equipment for piercing the skin and drawing blood. What appears to be a long, slender beak on the head of the mosquito is a sheath covering six small weapons. Some of these are shaped like miniature saws

It is very interesting to watch a mosquito take a meal on your hand.

and others are tubes for drawing the blood and injecting fluid into the wound.

When the mosquito bites, the sheath slides back and the entire group of lancets or weapons is plunged into the skin. It is the fluid that is pumped into the wound that is responsible for the swelling and itching that follows the bite. The female pumps the blood up through the tube, until her body is so swollen that she can barely fly away.

Within several days after she has eaten, the female usually lays her eggs. She flies to a pond or rainbarrel full of water and, resting on a leaf or the surface film of the water, lays from two to four hundred small, slender eggs. These eggs are attached together in the shape of a raft and float on the water. They are apparently waterproof because, if pushed down into the water, they bob up again as dry as ever.

The eggs hatch in a day or two and a small "wriggler" makes its escape from each. The wrigglers move about in the water by rapidly jerking their bodies back and forth. They eat small plants that float in the water and breathe through a tube on the end of their bodies. Soon the wrigglers change into pupae and float at the water surface, sinking only if disturbed. At last the skin of the pupa splits and the adult mosquito emerges. It stands on the floating pupa skin until its wings are dry and it is able to fly.

The bite of the common mosquito is irritating but not dangerous. However, some kinds of mosquitoes have been found to be the carriers of disease. Malaria and yellow fever are two of the diseases that are spread in this way. Only a certain kind of mosquito carries malaria; so it is a good idea to learn to recognize it. The malaria mosquito stands on its head to bite, and other mosquitoes usually hold their bodies parallel to the surface on which they stand.

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THE CECROPIA MOTH

by

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The Cecropia Moth

The story of a cecropia moth begins one summer night when hundreds of eggs are laid on the leaves of a box-elder tree by a female moth. If we examine one of the eggs, we see that it is very small, about the size of the head of a pin. For eight or ten days the egg remains attached to the leaf, showing no sign of life. Then one day the egg breaks and out crawls a very small black caterpillar. Its body is covered with small bumps called tubercles, and each tubercle bristles with spines. Very little time goes by before the insect crawls to the edge of one of the leaves and begins to eat. It systematically moves its head back and forth along the leaf and, when it crawls away, it leaves a gap in the leaf as proof of its large appetite.

After about four or five days of almost constant eating, this cecropia caterpillar has grown in size, as you can well imagine. But, although its body is growing larger, the stiff, horny skin will not stretch. So the outer skin is shed. Just before this happens, a new skin forms under the old one, and when the old skin splits, the new skin, which is still elastic and soft, stretches to give the growing caterpillar room. Soon the new skin hardens like the old one, but now the caterpillar does not look at all as it did when it hatched from the egg. Its new skin is an orange color and the tubercles are black.

For three or four weeks the caterpillar does very little but eat. It grows very rapidly and has to shed its skin three more times. Each time its new skin is a little different. Finally, after the last time, the caterpillar is larger than your finger and very brightly colored. Its skin is a bluish-green color and the tubercles are orange, yellow, and blue.

After a week or two, the caterpillar seems to grow restless and stops eating. It crawls slowly from one limb to another as if searching for something. At last

it stops on the underside of a twig, and its head begins moving from side to side. It is starting to build a silken framework all about its body by spinning silk from a gland in its lower lip. It works tirelessly at this until the silk is so thick around it that one can no longer see the caterpillar. Inside the silken screen, however, the caterpillar still works until there is a strong, tight casing of silk entirely surrounding it. Then, when the work is finished, the cecropia sheds its skin for the last time and changes into a pupa.

The pupa is not at all like the caterpillar in appearance. It is smooth and brown and looks like a lifeless thing. But underneath the brown covering amazing changes are taking place. The crawling caterpillar is slowly transforming into a large-winged moth. All winter long the pupa rests in the silk cocoon, waiting for the return of warm weather.

Then one day late in spring, sounds of activity can be heard coming from inside the cocoon, and one end begins to open as the moth pushes its way out. When you first see the moth as it clings to the empty cocoon, you may be disappointed, for its soft body is wet and its wings hang limp and crumpled. But slowly the wings lengthen and stiffen and the fuzzy body becomes sleek and bright. The rest of the day the moth clings to the cocoon, fanning its wings back and forth, gaining strength. Finally, when evening comes, it spreads its large wings and flies off into the night.

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THE MONARCH BUTTERFLY

by

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The Monarch Butterfly

In the early part of September, when the nights are becoming a bit chillier and the leaves are beginning to show faint tinges of color, the countryside is sometimes bright with the large black-and-orange butterflies called monarchs. Their flight appears to be slow and aimless, some of them soaring far above the trees and others drifting only a few feet from the ground. And yet, slowly, they are gathering and soon by the hundreds and thousands they will drift toward the south. Every fall this monarch migration takes place. These fragile butterflies journey from the northern United States and Canada to the southern coast of our country, stopping to rest only at night. What causes these insects to band together and make this long journey? What instinct tells them when the cold weather is approaching? These questions are as yet unanswered by science.

The first female monarchs to appear in the summer lay their eggs on milkweed plants because, although the larvae of some butterflies eat a variety of plants, the monarch caterpillar eats only milkweed. It grows very rapidly on its milkweed diet and is ready to make its chrysalis in twelve or fourteen days. When fully grown, it is about two inches long and very brightly colored, with black, white, and yellow stripes around its body. If it is annoyed, it frantically waves two black whip-like projections, near its head, that probably serve to frighten its small insect enemies. However, if you should touch one of these caterpillars, it will curl up into a ball

and drop to the ground, where it is very hard to see among the grass and leaves.

When the time comes for it to make its chrysalis, the caterpillar crawls until it finds a sheltered spot underneath a branch or leaf. There it spins a small button of silk and, sticking into the silk a sharp hook on the end of its body, hangs upside down. Slowly, as its skin splits, the chrysalis comes into view. It is light green with bright gold dots and looks like a piece of perfect jade that has been carved by a Chinese craftsman.

The chrysalis hangs motionless for about two weeks until all the changes are complete and the butterfly is ready to emerge. About a day before this happens, the chrysalis becomes very dark and almost transparent so that it is possible to see a faint outline of the markings on the butterfly's wings. Then, at last, the chrysalis skin splits and the monarch, now full grown, hangs from the empty skin while its wings dry and stiffen.

The monarch butterfly is a nectar eater. Coiled under its head is a long slender black tube that the butterfly uses to reach the nectar hidden in the flowers. As the monarch flies slowly from flower to flower, it is quite conspicuous with its bright markings and yet it is seldom attacked by insect-eating birds. For some reason, the monarch seems to be distasteful to birds and, apparently recognizing it by its color, they leave it alone. The viceroy butterfly profits from this also, for although the viceroy is not bitter tasting, it resembles the monarch so closely that it, too, is ignored by the birds.

It is quite simple to tell a female monarch from a male. The male has two black spots on its hind wings and the female has none. These black spots are in reality two little scent packets, and though the scent is too delicate for us to detect, it seems to attract the females to the males.

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THE LADYBIRD BEETLE

by

LORAIN FARMER
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The Ladybird Beetle

The ladybird beetle is familiar to almost everyone. Like a tiny, brightly colored armored tank, the little insect moves busily over leaves and grass-blades searching for food. Sometimes these beetles turn up in surprising places: on the living-room curtains or crawling rapidly up the inside of a window screen.

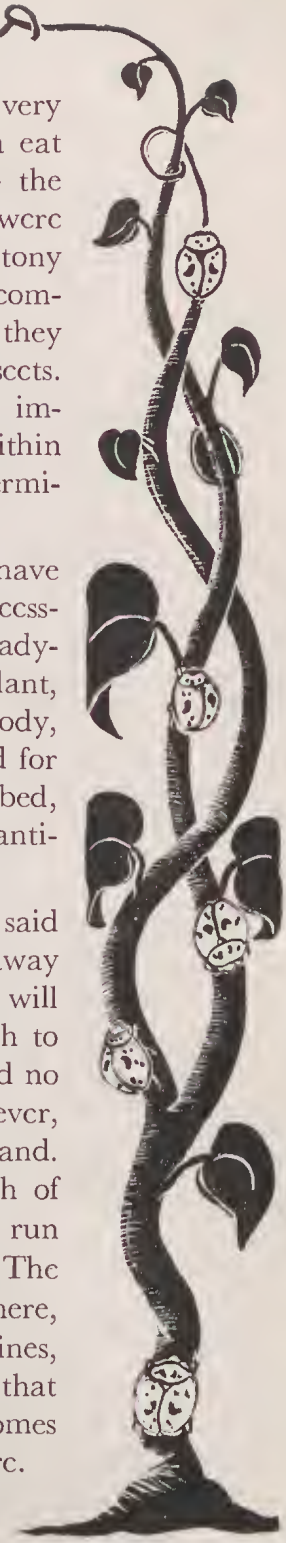
There are many different kinds of ladybirds. Like pills, they come in assorted shapes, sizes, and colors. Some are oval and some are round. Some are black with red spots and some red with black spots. All of them, however, have six short black legs that carry them about with surprising speed and a pair of long dark wings. The wings are kept hidden beneath the two shiny spotted wing-covers and are not usually visible when the beetle is not using them.

In the springtime the female ladybird beetle lays her eggs. They are not laid in a group like the eggs of many insects, but each one is placed on the leaf of a plant. When the egg hatches, out crawls an insect that does not resemble the adult beetle at all. It is long and soft, with six small legs that look almost useless. However, these legs serve the larva, as the young beetle is called, very well in hanging onto a stem or twig. As soon as it hatches, the larva goes in search of food. It eats mostly aphids and scale insects that are very injurious to our plants. Of course, like many immature insects, the larva outgrows its skin and has to shed it. After several molts, the larva is ready to change into a pupa. In some secluded spot, it hangs upside down by its tail and sheds its skin for the last time; then the pupa appears with the old skin draped around the top. After a few days, the pupa skin splits and the full-grown ladybird emerges. This takes place usually in the fall, and the beetle hurries to find some spot that is protected from ice and snow in which to spend the winter.

The ladybird beetle is an insect that is very helpful to man, for both adult and larva eat mostly harmful insects. Some years ago the orange and lemon trees in California were being ruined by an insect called the cottony cushion scale. The fruit growers were becoming very worried about their crops because they could not seem to destroy these harmful insects. Then a new kind of ladybird beetle was imported to California from Australia, and within a few years the ladybirds had nearly exterminated these pests and saved the fruit.

Although the ladybird beetle does not have many enemies, it protects itself quite successfully by playing opossum. If you touch a ladybird as it is running along the stem of a plant, it will probably fold its legs underneath its body, plummet to the ground, and lie as if dead for several minutes. Then, if not again disturbed, it will suddenly begin to wave its legs frantically in an effort to right itself.

Probably many of you have heard or said the old rhyme, "Ladybug, ladybug, fly away home, Your house is on fire, your children will burn." Of course there is not much truth to this because the ladybird has no house and no interest whatsoever in its children. However, the rhyme started a long time ago in England. The English children used to spend much of their time watching the ladybird beetles run about on the hop vines searching for food. The children thought that the beetles lived there, and so, when the farmers burned the hop vines, as they did every year, the children said that the young ladybird beetles and their homes were being destroyed by the heat of the fire.



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THE CRICKET

by

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The Cricket

There are many animals that have been used by man for entertainment. The ancient Romans gathered in large arenas to watch their favorite gladiators fight lions, and today, in much the same way, the Mexicans and Spaniards cheer as the colorful toreador uses his skill against the bull. Cock fights have been held in many different countries, from the United States to faraway Java. But one of the smallest animals ever to be used in this way is the tiny cricket. For many years cricket fighting has been a common entertainment in China. The Chinese keep their pets in small cages, complete with miniature beds and tiny porcelain dishes for food.

Although crickets have not been kept as pets or watched as carefully in other countries, they have been associated with man for many years. It is still common in England to hear the chirping of the house cricket around the fireplace on cool autumn evenings, and many times in this country crickets find their way inside the house when the weather gets chilly. Crickets make the rather harsh, though pleasant, chirping noise that you often hear outdoors during the summer months.

Usually the chirping starts in the afternoon and continues off and on throughout the night. Only the male crickets can make this sound, and probably it serves to attract the females. This chirping does not come from the throat of the cricket as you might expect, but it is made by the wings. There is a kind of file on the forewing of the cricket and a hardened knob-like piece on the hind wing. When the cricket chirps, it draws the file rapidly over the knob and thus produces the noise. Its wings move so very rapidly that only their blurred outline can be seen.

When a male cricket hears another male's song, it immediately draws its wings higher and a louder, harsher note is given off. If the other male comes into view,

there is a battle, and the two crickets rush at each other, each trying to overcome the other. The fight continues until one gives up and retreats, usually carrying several battle scars with it. When the Chinese have their cricket fights they sometimes award an ivory medal to the victor.

The black, slick armor of the cricket makes it difficult to catch, and even after one is captured, it will slip easily out of even a tiny crack or crevice. Although not as expert as the grasshopper, the cricket can jump for a surprising distance, considering its small size. Near its hind feet are several small spines, like the spikes on a runner's shoes, that give the insect a firm grip before it jumps. It crouches until its legs are completely doubled back and then, like a spring, its legs straighten and it shoots off into the air.

Crickets can usually be found in some sunny spot out-of-doors during the summer. Many times they make some sort of small hole under a rock or piece of dirt and bask there in the sun. The female cricket places her eggs down in the ground by means of a long sword-shaped ovipositor, or egg-layer, on the end of her body. The eggs remain beneath the ground protected from the cold during the long winter and hatch the next spring. The newly hatched crickets are small replicas of their parents, except that they have no wings. Crickets do not change from larva to pupa to adult as do the butterflies and moths. The cricket grows by shedding its skin, and, except that its wings appear after the final molt, it looks almost the same throughout its entire lifetime.

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THE CADDISFLY

by

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Raymond Foundation

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November 27, 1948

The Caddisfly

Some spring when you are in the country, find a cool clear stream, make yourself comfortable on the bank, and then look down into the water. You will see a whole new world of animal life. As you first glance at the stream, you will probably see a long-legged water strider moving rapidly over the surface of the water, supported by nothing more than the thin surface film.

Beneath the strider, on the bottom of the stream, the strange dragonfly nymph moves slowly among the water plants looking for food. Suddenly, its long arm-like lower lip reaches out and a luckless insect is seized in the strong pincers, brought back to the jaws, and quickly devoured. Once more the nymph moves on in its never-ending search for food. Again the pincers dart out, this time directed toward a slender worm-like insect. But when the pincers close, there is nothing between them. The insect has disappeared and nothing remains but a small pile of sticks. This insect magician is the caddisfly nymph, or larva, and its magic is quite easily explained.

The nymph, as soon as it hatches from the egg, builds itself a house. Spinning silk from a gland in its lower lip, it makes a tube-shaped structure lined with silk on the inside and covered with sticks on the outside. The nymph holds fast to the silk by means of two small hooks on the end of its body. When the insect is looking for food or swimming, it sticks its body quite far out of one end of the house; but the moment danger threatens, it draws itself quickly back into its shelter, where it is protected from its many enemies.

Unlike the snail, the caddisfly larva can move about inside of its house, for the house is not a part of its body, although it always keeps a hold on the silk so that it can retreat at the slightest warning. The larva breathes by means of little white thread-like gills on its body. The water is kept flowing past the gills by the larva, whose movements send the water in the front opening of the house and out the back. When it swims, the insect pushes its body far out of the front of its house and then quickly doubles up. This action sends it forward in short, jerky motions.

There are many different kinds of caddisflies, and their houses are made from a great variety of materials. Some use sticks, some stones, some leaves, and others even make use of little pieces of broken snail shells. A number of kinds make no house at all. Most caddisfly nymphs eat only vegetable material, but there are a few that eat small animals.

When the nymph is ready to change to a pupa, it fastens its house to a water plant or stone and closes the openings with a net of silk. Secure in this shelter, the pupa rests until the time comes for it to make the final change into an adult caddisfly. Then it leaves its house for the first time, makes its way out of the water, sheds its old skin, and flies away. The adult caddisfly looks a little like a small moth.

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